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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 3: Application layer conformance test plan

Véhicules routiers — Système de transport axé sur les médias — Partie 3: Plan d'essais de conformité de la couche d'application

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

A list of all parts in the ISO 21806 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The Media Oriented Systems Transport (MOST) communication technology was initially developed at the end of the 1990s in order to support complex audio applications in cars. The MOST Cooperation was founded in 1998 with the goal to develop and enable the technology for the automotive industry. Today, MOST[1)] enables the transport of high quality of service (QoS) audio and video together with packet data and real-time control to support modern automotive multimedia and similar applications. MOST is a function-oriented communication technology to network a variety of multimedia devices comprising one or more MOST nodes.

Figure 1 shows a MOST network example.

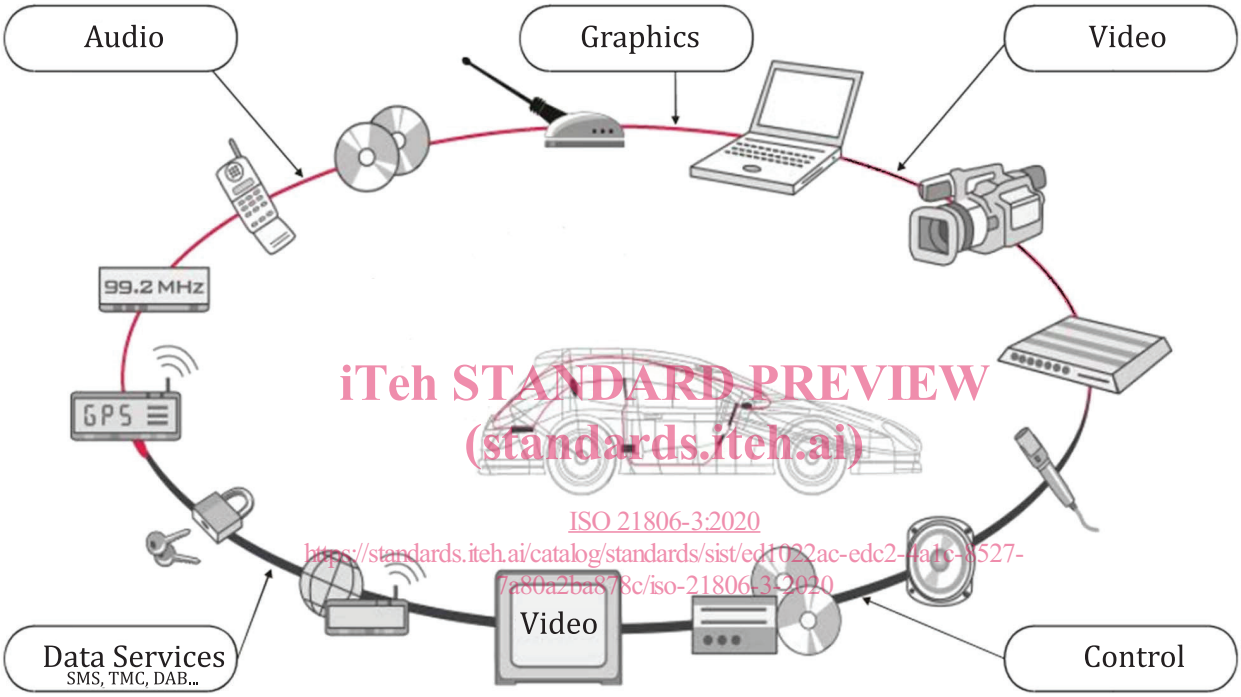

Figure 1 — MOST network example

The MOST communication technology provides:

— synchronous and isochronous streaming,

— small overhead for administrative communication control,

— a functional and hierarchical system model,

— API standardization through a function block (FBlock) framework,

— free partitioning of functionality to real devices,

— service discovery and notification, and

— flexibly scalable automotive-ready Ethernet communication according to ISO/IEC/IEEE 8802-3[2].

MOST is a synchronous time-division-multiplexing (TDM) network that transports different data types on separate channels at low latency. MOST supports different bit rates and physical layers. The network clock is provided with a continuous data signal.

1) MOST® is the registered trademark of Microchip Technology Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO.

Within the synchronous base data signal, the content of multiple streaming connections and control data is transported. For streaming data connections, bandwidth is reserved to avoid interruptions, collisions, or delays in the transport of the data stream.

MOST specifies mechanisms for sending anisochronous, packet-based data in addition to control data and streaming data. The transmission of packet-based data is separated from the transmission of control data and streaming data. None of them interfere with each other.

A MOST network consists of devices that are connected to one common control channel and packet channel.

In summary, MOST is a network that has mechanisms to transport the various signals and data streams that occur in multimedia and infotainment systems.

The ISO standards maintenance portal (https://standards.iso.org/iso/) provides references to MOST specifications implemented in today's road vehicles because easy access via hyperlinks to these specifications is necessary. It references documents that are normative or informative for the MOST versions 4V0, 3V1, 3V0, and 2V5.

The ISO 21806 series has been established in order to specify requirements and recommendations for implementing the MOST communication technology into multimedia devices and to provide conformance test plans for implementing related test tools and test procedures.

To achieve this, the ISO 21806 series is based on the open systems interconnection (OSI) basic reference model in accordance with ISO/IEC 7498-1[1] and ISO/IEC 10731[3], which structures communication systems into seven layers as shown in Figure 2. Stream transmission applications use a direct stream data interface (transparent) to the data link layer.

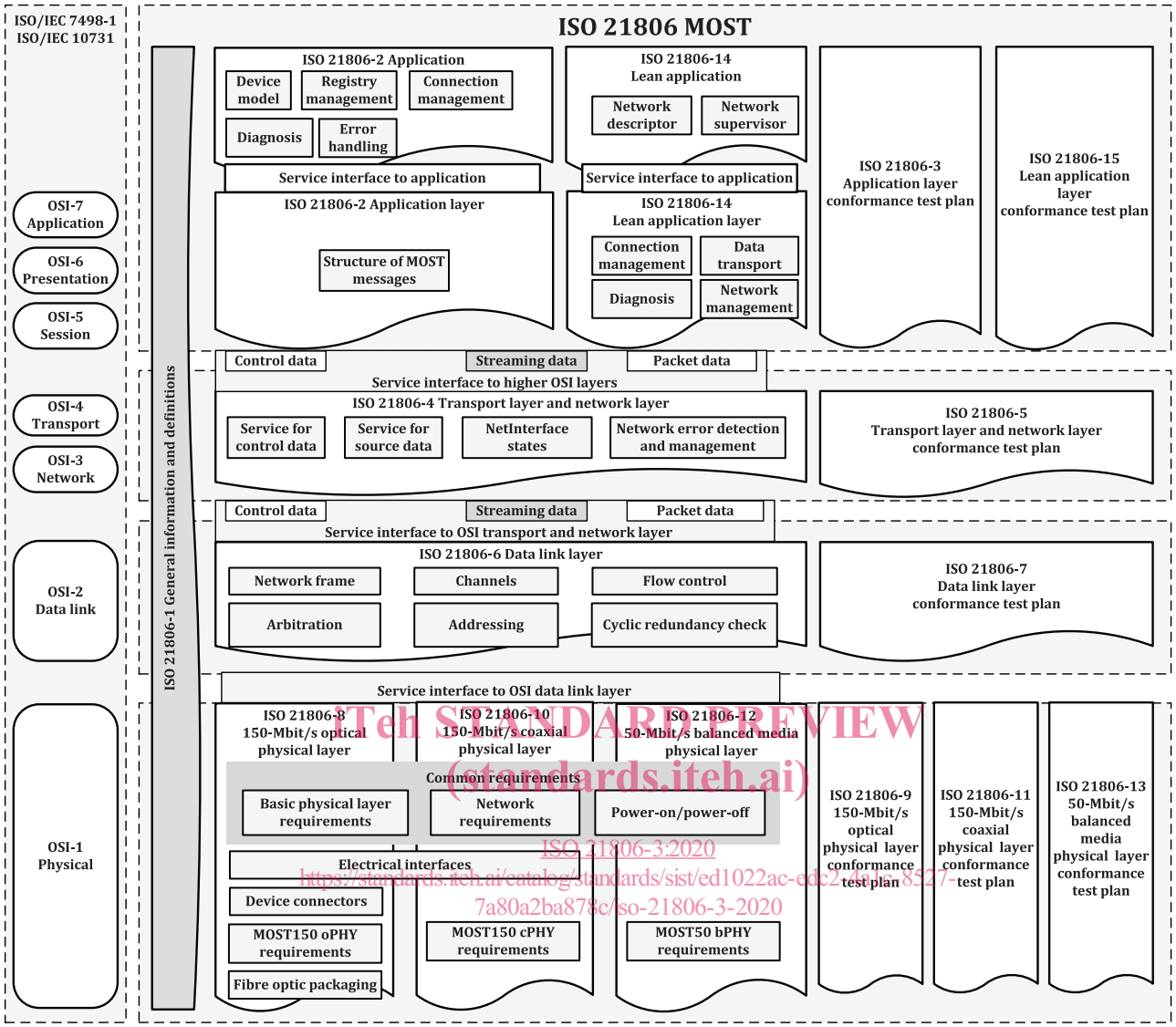

Figure 2 — The ISO 21806 series reference according to the OSI model

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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 3: Application layer conformance test plan

1 Scope

This document specifies the conformance test plan (CTP) for the application layer for MOST, a synchronous time-division-multiplexing network, as specified in ISO 21806-2.

This document specifies conformance test cases (CTCs) in the following categories:

— device model;

— data and basic data types;

— registry management;

— connection management;

— error management;

— diagnosis.

Interoperability testing is not in the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 9646-1:1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 1: General concepts*

ISO 21806-1:2020, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 1: General information and definitions*

ISO 21806-2:2020, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 2: Application layer*

ISO 21806-4:2020, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 4: Transport layer and network layer*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21806-1, ISO 21806-2, ISO 21806-4, ISO/IEC 9646-1, and the following apply.

ISO and IEC maintain terminological databases for use in standardisation at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
REPEAT
pseudo code command for an iteration

3.2
REPEAT END
pseudo code command for ending an iteration

4 Symbols and abbreviated terms

4.1 Symbols

--- empty cell/undefined

4.2 Abbreviated terms

CTC	conformance test case
CTP	conformance test plan
CR	central registry
DR	decentral registry
IUT	implementation under test
LT	lower tester
MPI	maximum position information
MSC	Message Sequence Chart
NCE	network change event
OSI	Open Systems Interconnection
UT	upper tester

5 Conventions

This document is based on OSI service conventions as specified in ISO/IEC 10731[3] and ISO/IEC 9646-1 for conformance test system set-up.

6 CTP overview

6.1 Test set-up

All CTCs are based on the same test set-up with an upper tester (UT) and a lower tester (LT). The LT contains the lower tester pre-IUT (LT pre-IUT) and the lower tester post-IUT (LT post-IUT).

Figure 3 specifies the test set-up.

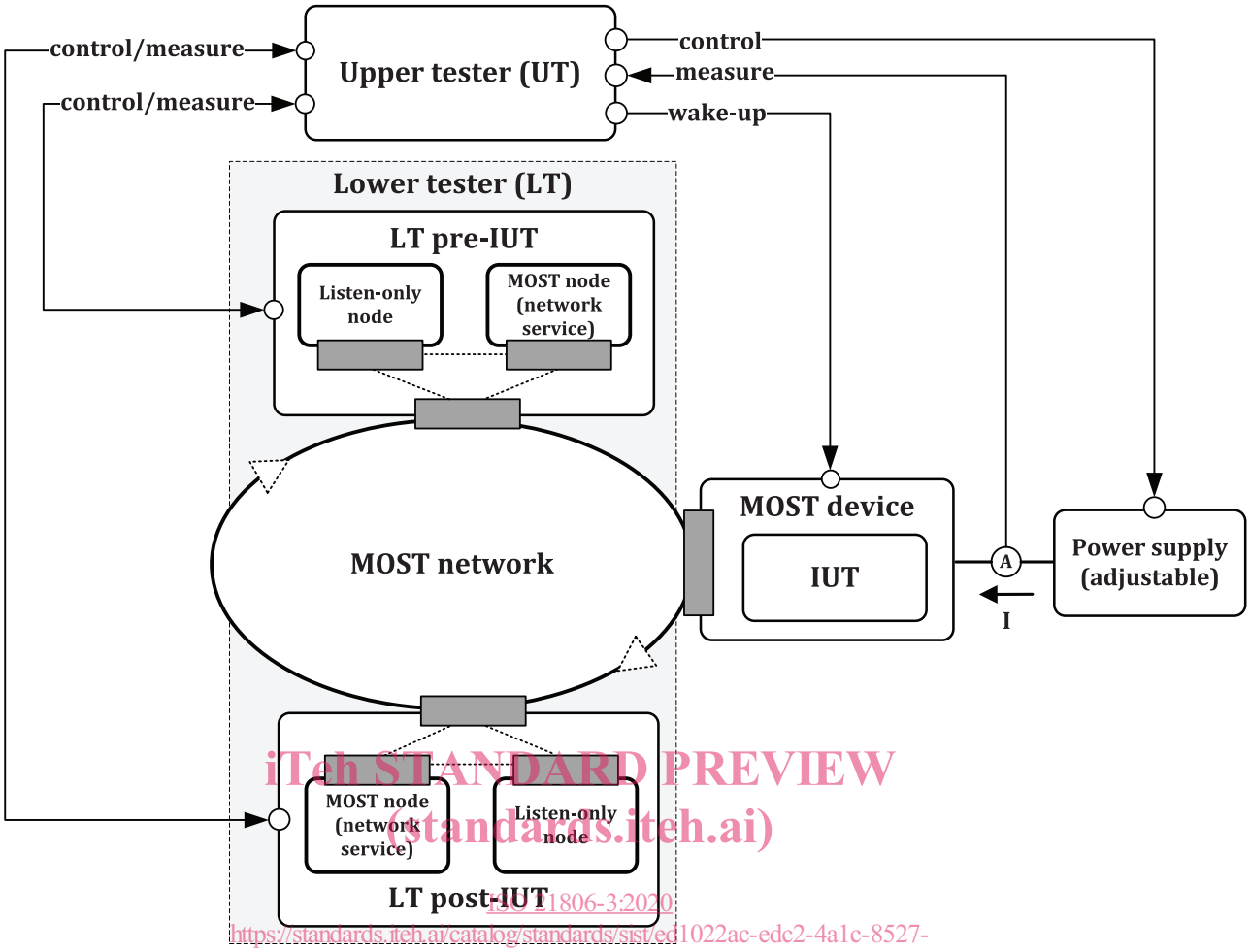


Figure 3 — Test set-up

The LT pre-IUT and the LT post-IUT implement the application layer services and the lower layer services of a MOST node in accordance with the ISO 21806 series. They also contain a listen-only node in front of the MOST node to log the whole communication. The MOST node is able to operate as TimingMaster or TimingSlave; alternatively, it can be physically disconnected from the MOST network. If it is disconnected, the associated LT pre-IUT or LT post-IUT serves as listen-only node.

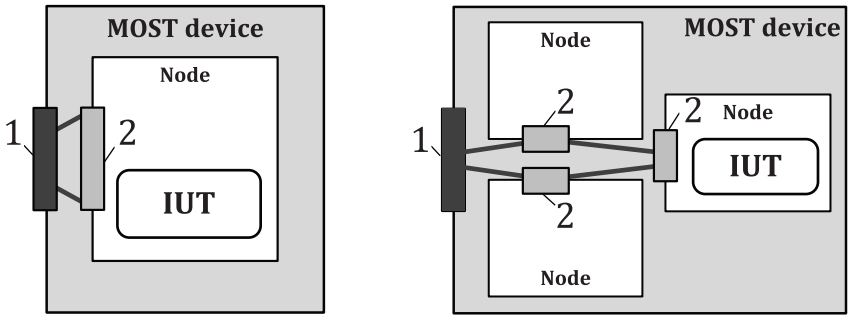
Every CTC specifies the roles of the LT pre-IUT and the LT post-IUT.

During testing of the MOST device that implements the IUT, avoid over-temperature by following the manufacturer recommendations regarding cooling.

The power supply of the MOST device that contains the IUT is adjustable and the power consumption can be monitored by the UT. This is necessary to determine whether a node has entered `s_NetInterface_Sleep`.

A MOST device contains one or more nodes, which are connected to an external MOST physical interface. One of the nodes contains the implementation under test (IUT). All tests and timings, specified by the CTP, are related to the external MOST physical interface.

Figure 4 shows a MOST device with one node and a MOST device with three internal nodes.



1 external MOST physical interface
2 internal MOST physical interface

Figure 4 — MOST device with one node and MOST device with three nodes

6.2 Conformance test plan organisation

CTCs are independent of one another. Each CTC checks the behaviour of the IUT for requirements stated in ISO 21806-2. Within CTCs, which require variations of individual parameters, each specified value of the parameter is iterated.

The measurement uncertainty for each CTC shall be in accordance with Annex A.

7 CTP general information

7.1 CTC remarks

7.1.1 Timer naming

For conformance testing of the IUT, the UT and LT need minimum and maximum timers. The names of the timers used by this document are based on ISO 21806-2 and ISO 21806-4. To obtain the timer name, for minimum and maximum, "_min" and "_max" are appended, respectively. Table 1 shows a timer naming definition example for t_{Config}.

Table 1 — Timer naming example

Name	Minimum value name	Typical value name	Maximum value name	Unit	Purpose
t_{Config}	t_{Config_min}	t_{Config}	t_{Config_max}	ms	Time before `ev_Init_Error_Shutdown` or delay for RBD result.

7.1.2 Deadlock prevention

This document specifies the timeouts $t_{DeadLockShort}$, $t_{DeadLockMid}$, and $t_{DeadLockLong}$ to prevent deadlock situations during conformance testing. These are the default values:

— $t_{DeadLockShort}$: 1 s;

— $t_{DeadLockMid}$: 20 s;

— $t_{DeadLockLong}$: 5 min.

These timeouts are only relevant for conformance testing and may be extended.

7.1.3 Un-initialised logical node address

The variable `uninitialised_node_address` is defined as the address of an un-initialised node, which is specified in ISO 21806-2.

7.1.4 Addresses of MOST nodes in the LT

The address of a MOST node in the LT is the default logical node address corresponding to the node position.

If this address is in conflict with the address of a node that contains the IUT (e.g. if a supplier uses static addresses in the dynamic address range), the affected MOST node in the LT shall use a valid free address.

7.1.5 Device manufacturer information list

This list contains all information that is provided by the device manufacturer for conformance testing. It also includes remarks and references to corresponding CTCs.

Table 2 shows the device manufacturer information list, which does not include information stored in FBlock EnhancedTestability.

Table 2 — Device manufacturer information list

Category	Item/property	Description	Reference to CTC
MOST network configuration	IUT in the TimingMaster	Determines whether the IUT is part of the TimingMaster.	All CTCs
	IUT in the NetworkMaster	Determines whether the IUT is part of the NetworkMaster.	All CTCs
	IUT in the PowerMaster	Determines whether the IUT is part of the PowerMaster.	All CTCs
	IUT in the connection manager	---	CTC_3.1-3, CTC_3.1-4, CTC_3.1-5, CTC_3.1-6, CTC_3.2-3, CTC_3.2-4, CTC_3.2-5, CTC_3.2-6, CTC_3.2-7, CTC_3.2-8, CTC_3.2-9, CTC_3.2-14
	Multi-node device	If the IUT is part of a MOST device that contains more than one node, the following information is provided: — number of nodes in the MOST device; — topology of the MOST device (position of PowerMaster and TimingMaster/ NetworkMaster); — position of the node that contains the IUT.	All CTCs
	IUT sample frequency	If the IUT is not part of the TimingMaster, the LT provides the correct network frame rate (44,1 kHz or 48,0 kHz).	All CTCs
	Required value of boundary descriptor (if the TimingMaster is in the LT)	Value of the boundary descriptor. Unless otherwise stated, all CTCs are performed with this value of the boundary descriptor.	All CTCs
	$mi_{\text{MaxInvalidReg}}$	The maximum number of permitted conflicting node address registrations by a NetworkSlave.	CTC_2.6.2-3a
	$mi_{\text{MaxSetNewInstID}}$	When an invalid InstID registration occurs, the NetworkMaster sends a request to the NetworkSlave for setting a new InstID.	CTC_2.6.2-6
	$t_{\text{Config\_max}}$	Time before ev_Init_Error_Shutdown or delay for RBD result.	CTC_2.1.1-6b
	$t_{\text{ConfigurationAnnounce}}$	Limit for the NetworkMaster to set the central registry state.	CTC_2.6.2-4a, CTC_2.6.2-5
	$t_{\text{WaitForAnswer\_min}}$ $t_{\text{WaitForAnswer\_max}}$	Time the NetworkMaster waits for all NetworkSlaves to respond.	CTC_2.6.2-1, CTC_2.6.2-3b, CTC_2.6.2-5

Table 2 *(continued)*

Category	Item/property	Description	Reference to CTC
Power management	Node that contains the IUT supports `s_NetInterface_Sleep`	Determines whether the node that contains the IUT supports `s_NetInterface_Sleep`: — yes: the MOST device that contains the IUT reduces its power consumption below threshold before timeout expires; — no: the reduction of power consumption is not detectable.	CTC_2.3.2-3
	`s_NetInterface_Sleep`: $I_{NetInterfaceSleep\_Threshold}$	Threshold of current for `s_NetInterface_Sleep` detection	See 7.1.6.
	`s_NetInterface_Sleep`: $t_{PwrSwitchOffDelay\_min}$ $t_{PwrSwitchOffDelay\_max}$	$t_{PwrSwitchOffDelay\_min}$ Specific timeout for `s_NetInterface_Sleep`; after the end of network activity, the node that contains the IUT does not enter `s_NetInterface_Sleep` (reduced power consumption) before $t_{PwrSwitchOffDelay\_min}$ expires. $t_{PwrSwitchOffDelay\_max}$ MOST device specific timeout for `s_NetInterface_Sleep`; after the end of network activity, the node that contains the IUT enters `s_NetInterface_Sleep` (reduced power consumption) before $t_{PwrSwitchOffDelay\_max}$ expires.	CTC_2.3.2-3, CTC_2.6.4-1
	Wake-up preconditions	Preconditions for the node that contains the IUT for wake-up. Supplemented by information whether the node that contains the IUT needs additional conditions during operation (e.g. ignition ON) to stay in `s_NetInterface_Normal_Operation`.	See 7.1.6.
	Node that contains the IUT is capable of waking via network startup (i.e. switching on its MOST output)	---	CTC_2.4.1-2
	Delay between connection to power (of the MOST device that contains the IUT) and the ability of the node that contains the IUT to detect wake-up events	Potentially, the UT (see Figure 3) waits for a short period of time between connecting the MOST device that contains the IUT to power and switching on the MOST output to wake up the node that contains the IUT. Otherwise, the node that contains the IUT does not detect a wake-up event.	All CTCs
	`s_NetInterface_Normal_Operation`: Delay until all FBlocks of the node that contains the IUT are available after `Configuration.Status(OK)` (equivalent to $t_{WaitForApplication}$)	This delay covers: — NetworkMaster: period of time the node that contains the IUT needs to add own FBlocks to its central registry after `Configuration.Status(OK)`; — NetworkSlave: delay between `ev_Init_Ready` and availability of application.	See 7.1.6. CTC_2.6.2-3b
	$t_{WaitBeforeScan}$	Specific limit for the NetworkMaster to start an FBlock scan.	CTC_2.4.1-9, CTC_2.6.2-5, CTC_2.6.4-8